



Pall Corporation

Pressure swing adsorption (PSA) CBRN protection

Traditional CBRN protection has used carbon filters to remove various agents, and although the technology has been developed over the years, some modern chemical agents are capable of passing through standard carbon, leading to specialised chemical treatments to make the carbon “bind” with specific threats. Pall research has led to an evaluation of all known technologies to identify a suitable method of producing a CBRN filter which would be effective against all known chemical warfare agents. **The most suitable technology was identified as pressure swing adsorption (PSA).**

PSA Technology

Pressure Swing Adsorption (PSA) is a technology used to separate unwanted components from a gas under pressure according to their molecular size and affinity for a suitable adsorbent material. It operates at near-ambient temperatures using adsorptive materials such as zeolites as a molecular sieve, preferentially adsorbing the unwanted gases at elevated pressure. The process then swings to ambient pressure to desorb captured gases from the adsorbent material. The use of two adsorbent vessels allows near-continuous production of the required gas.

Pall has applied the technology to the production of pure breathing air from ambient air contaminated with chemical, biological, radiological and nuclear (CBRN) materials to achieve full CBRN protection for fighting vehicles, ships, aircraft and any other enclosed spaces operating at a slight overpressure.

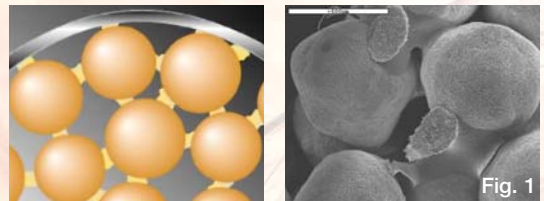
The adsorptive material is a specially selected zeolite which has the capability of removing all chemical agents with a boiling point between -84°C and 280°C . This also includes the materials known as TICs and TIMs (toxic industrial chemicals/materials) such as solvents, sulphur dioxide, ammonia, chlorine etc.

PSA performance is enhanced by producing a two layer bed, the first layer being carbon to remove any higher boiling point agents and relieve the load on the second layer. This is composed of molecular sieve which has been selected to remove the lower boiling point contaminants that traditional carbon will not retain, and gives the broad band CBRN protection necessary to counter all current threats.



Immobilised adsorbent beds

Normally the materials forming the two beds are prone to attrition and dusting caused by the pressure swing process, leading to degradation of the beds and eventual channelling, rendering the unit ineffective. Pall has developed a patented production process to immobilise the beds, thus ensuring long life and stable performance under the somewhat arduous cyclic conditions inherent in a PSA bed. (See Fig. 1)



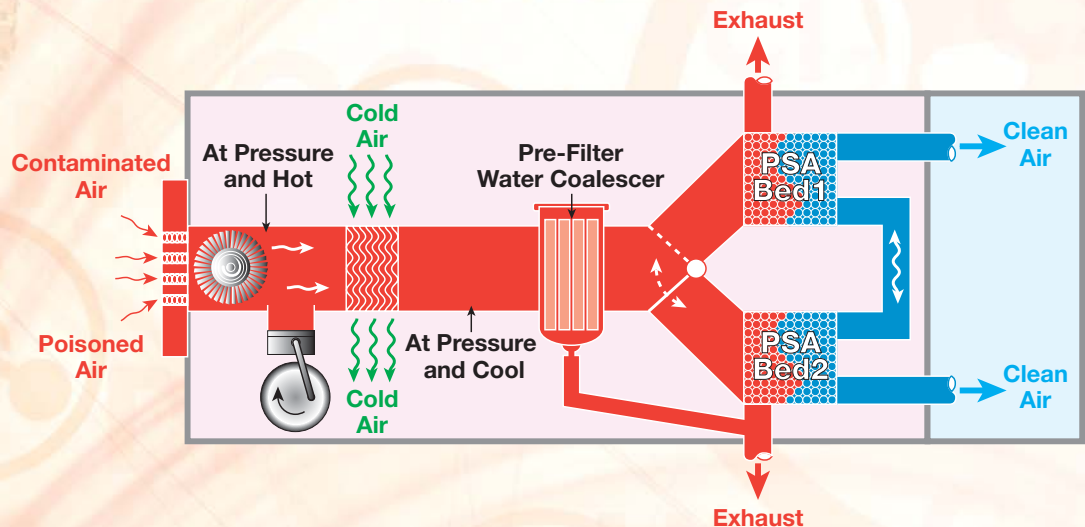
Laboratory endurance testing has shown that the unit can successfully remove simulant challenges after running for durations in excess of 1000 hours.

Typical simulants used are Freon® R23 (penetrant simulant) and DMMP (nerve agent simulant)

Live agent testing has been carried out on demonstrator units both in the UK and USA and passed successfully. The unit has also been integrated into the Ametek environmental control system (ECS) demonstrator fitted to the Terrier general support engineering vehicle. The ECS has passed full qualification requirements, making the Pall PSA unit the first fully qualified regenerable CBRN unit available.

The PSA Technology Cycle

The unit operates by adsorbing contaminants while under pressure. The purified air passes through the unit and is available for use, the contaminants remaining trapped on the adsorbent due to their larger molecular size. After a pre-defined period the pressure is quickly released to ambient, releasing the trapped contaminants which are then purged to waste by back flushing with a proportion of the purified air from the on line unit. The unit then cycles again bringing the flushed unit back on line and purging the unit previously on line. This cycling (pressure swing) results in a fully regenerable unit which has a theoretically infinite life, ensuring the unit requires minimal maintenance and can be considered "Fit and Forget".



The Advantages of using Pall PSA units

- Fully regenerable
- Requires only minimal preventative mechanical maintenance at suitable periods, to coincide with maintenance of the platform to which it is fitted
- In the event of a CBRN attack the unit will provide protection immediately and indefinitely, with no requirement to leave the battleground
- PSA Units can be back flushed at elevated temperature to clean and return the unit to original condition during decontamination of the platform at base after an event
- There are no disposable parts, unlike carbon filters which have a finite life and pose attendant problems of safe disposal and the necessity of handling potentially deadly filter assemblies.

For more information on Pall PSA CBRN protection. Please contact the Pall Sales offices on the numbers below



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